

Fig. 1

Dielectric Constants of Selected Materials.

Material	Dielectric Constant
Air	1.0
Quartz	3.4
Water	80
TCE	3.390
PCE	2.268

(From Or et al., 1998; CRC, 2000).

Fig. 2

$$\Phi = \frac{\rho_{ma} - \rho_b}{\rho_{ma} - \rho_f}$$

where:

Φ = porosity

ρ_{ma} = matrix density (2.65 g/cm³, quartz)

ρ_b = formation bulk density

ρ_f = average density of pore fluid (1.00 g/cm³, water)

Fig. 3

$$\rho_b = (1-\Phi)\rho_{ma} + \Phi\rho_f$$

where:

Φ = porosity

ρ_{ma} = matrix density (2.65 g/cm³, quartz)

ρ_b = formation bulk density

ρ_f = average density of pore fluid (1.00 g/cm³, water; 1.4 g/cm³, DNAPL)

Fig. 4

$$0\% \text{ DNAPL: } \rho_b = (0.8)*(2.6) + (0.2)*(1) = 2.28 \text{ g/cm}^3$$

$$50\% \text{ DNAPL: } \rho_b = (0.8)*(2.6) + (0.1)*(1) + (0.1)*(1.4) = 2.32 \text{ g/cm}^3$$

$$100\% \text{ DNAPL: } \rho_b = (0.8)*(2.6) + (0.2)*(1.4) = 2.36 \text{ g/cm}^3$$

Fig. 5

$$\% \text{ change} = \frac{(2.36-2.28)}{2.28} = .035 * 100\% \cong 4\% \text{ change in bulk density}$$

Fig. 6

$$\epsilon_b = [\theta v * \epsilon_w^\beta + (1-\eta) \epsilon_s^\beta + (\eta - \theta v) \epsilon_c^\beta]^{1/\beta}$$

where:

- ϵ_b = bulk dielectric
- θv = fractional fluid volume
- ϵ_w = water dielectric
- ϵ_s = soil dielectric
- ϵ_c = DNAPL dielectric
- η = porosity
- β = constant, usually 0.5

Fig. 7

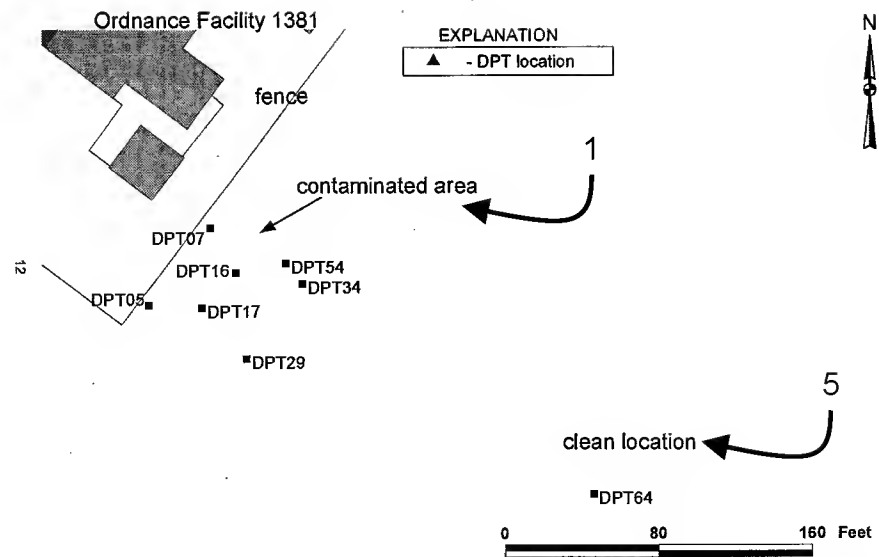


Fig. 8

Selected DPT results for dissolved TCE in vicinity of study area, (concentrations in $\mu\text{g/L}$).

elev. depth	-2 ft 10 ft	-7 ft 15 ft	-12 ft 20 ft	-17 ft 25 ft	-22 ft 30 ft	-27 ft 35 ft	-32 ft 40 ft	-37 ft 45 ft	-42 ft 50 ft
DPT 05	53,000	382,000	238,000	97,000	87,500	16,800	1000		
DPT 07	1,260	189,000	1,050,000	608,000	4,400	10,200	7,500		
DPT 29	23,300	261,000	18,600	51,200	732	33.2	1,860		
DPT 34	5,200	52,800	961,000	192,000	2,200	889,000	169,000		
DPT 16	4,330	1,370,000	532,000	352,000	257,000	112,000	105,000	165,000	2,170
DPT 54	1,550	676,000 (-6 ft)	958,000 (-10 ft)	47,000	9,100	12,600	1,060	955	2,750
DPT 16	1.0 U		1.0 U		1.0 U		1.0 U		

Where: U = analyte analyzed for but not detected at corresponding detection limit

Fig. 9

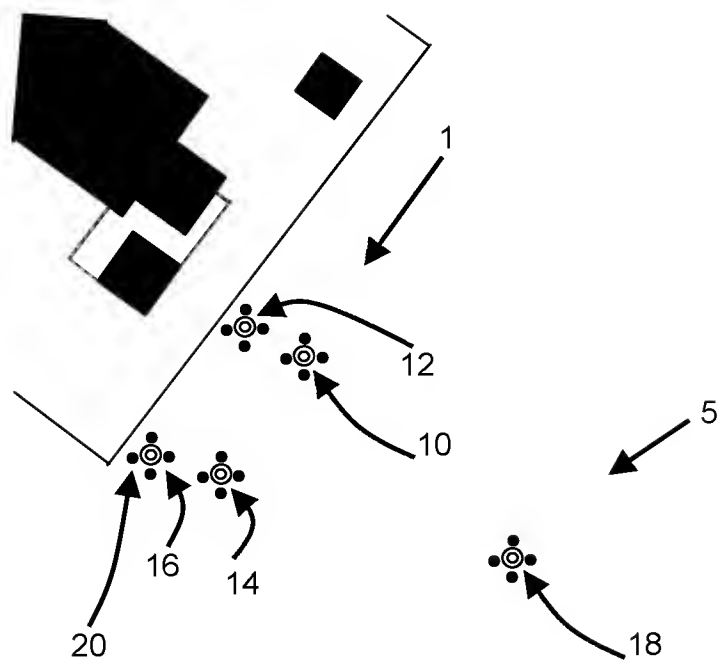


Fig. 10

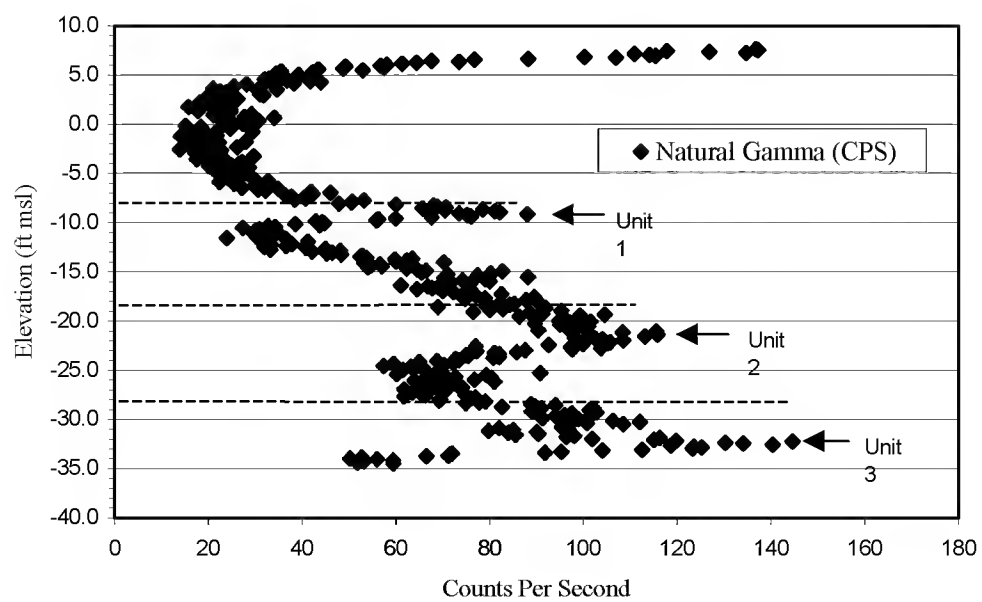


Fig. 11

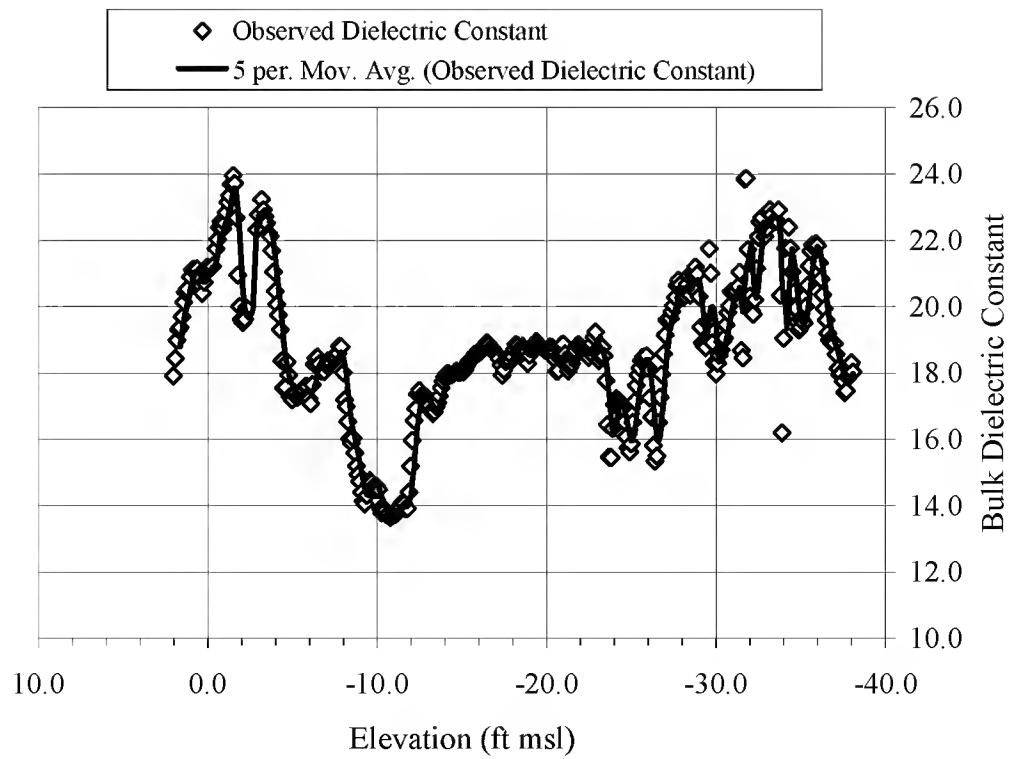


Fig. 12

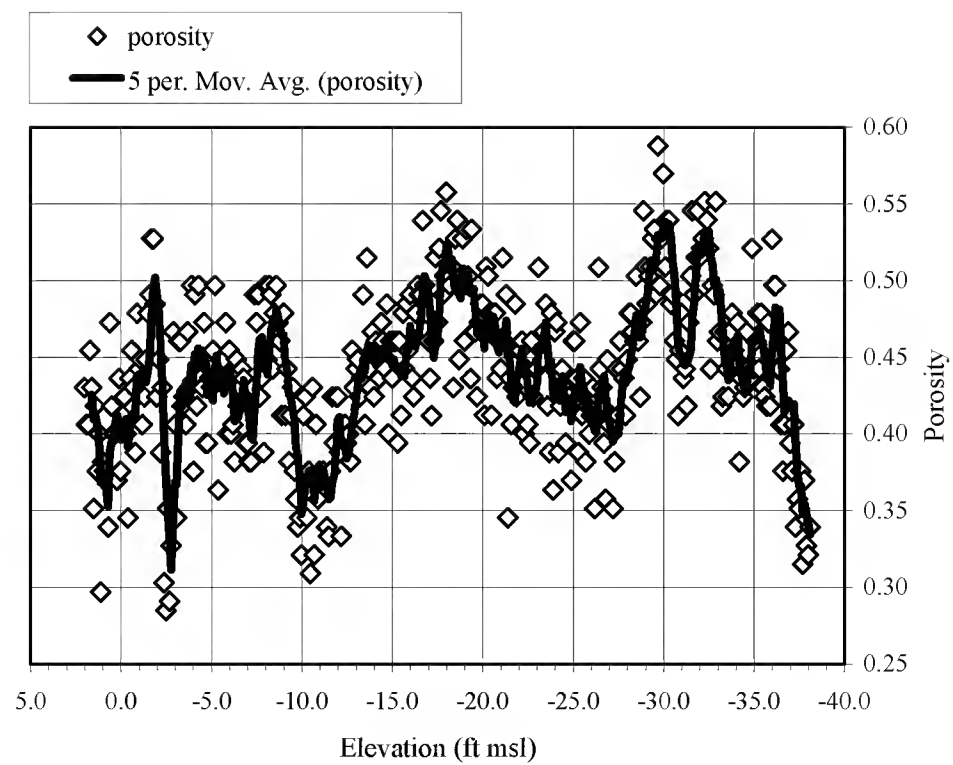


Fig. 13

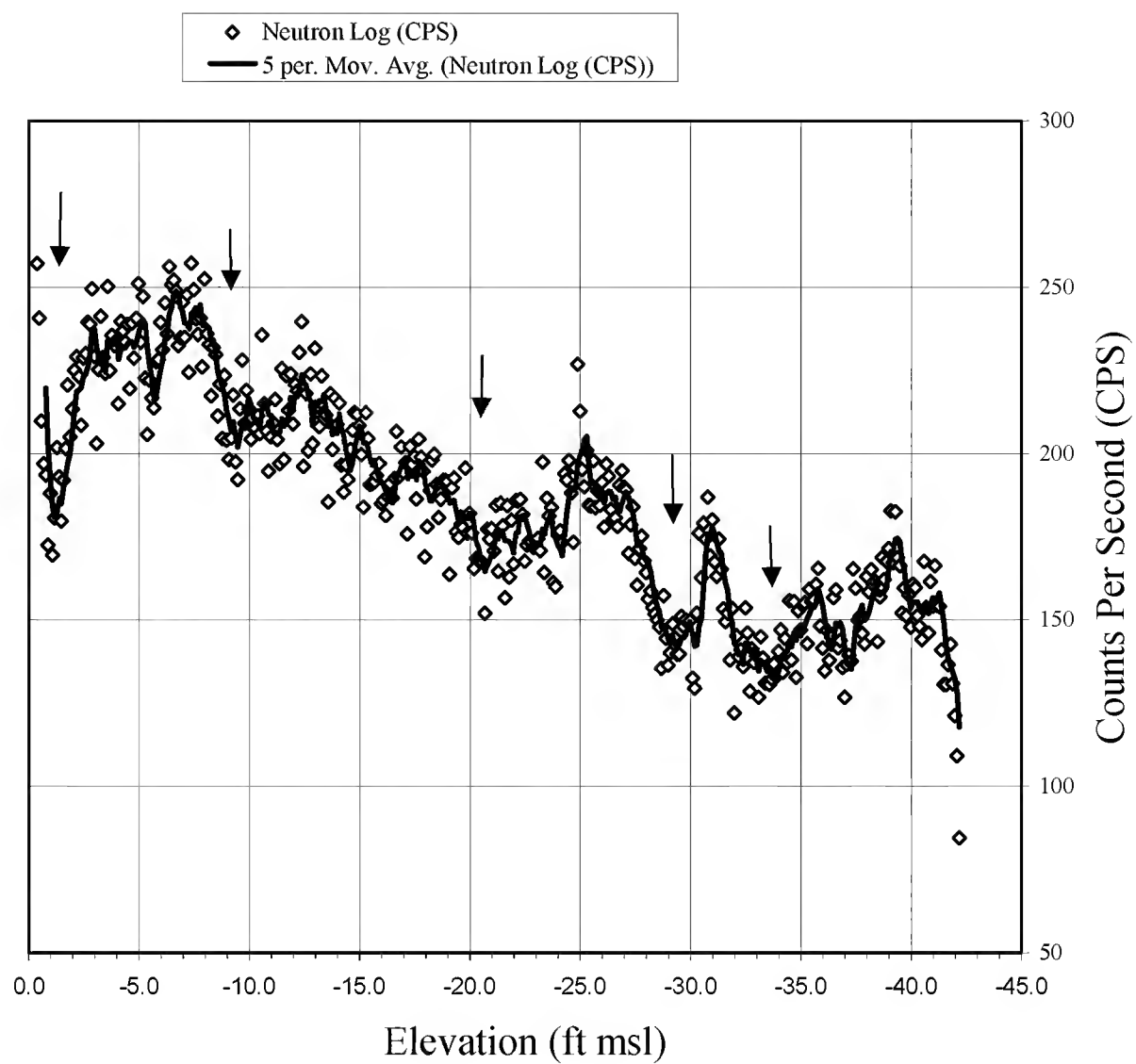


Fig. 14

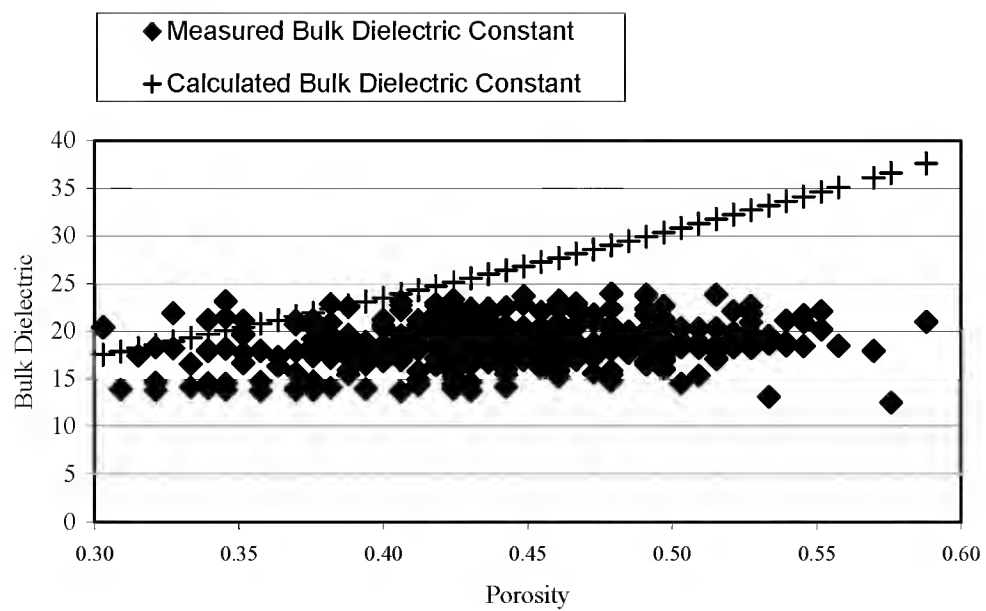


Fig. 15

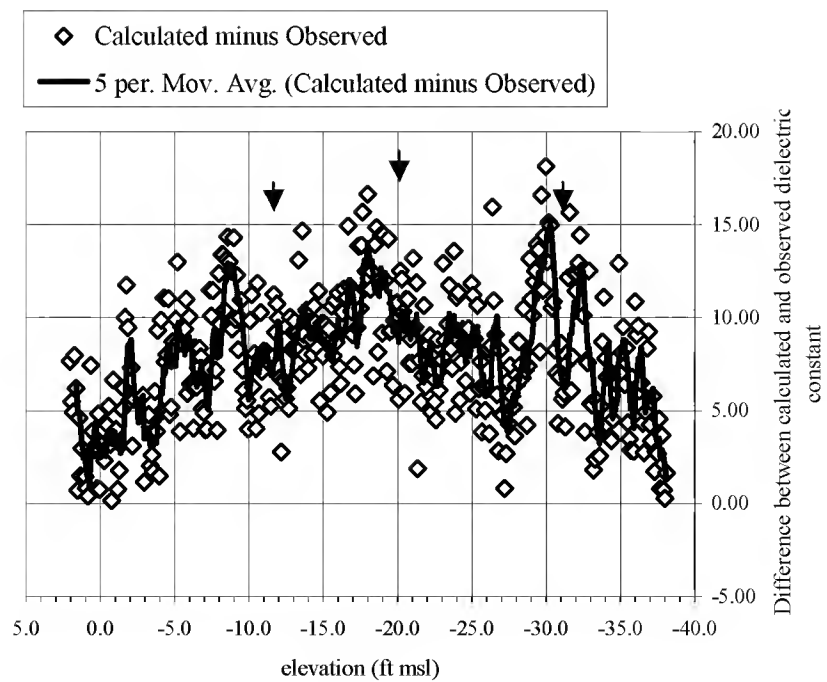


Fig. 16

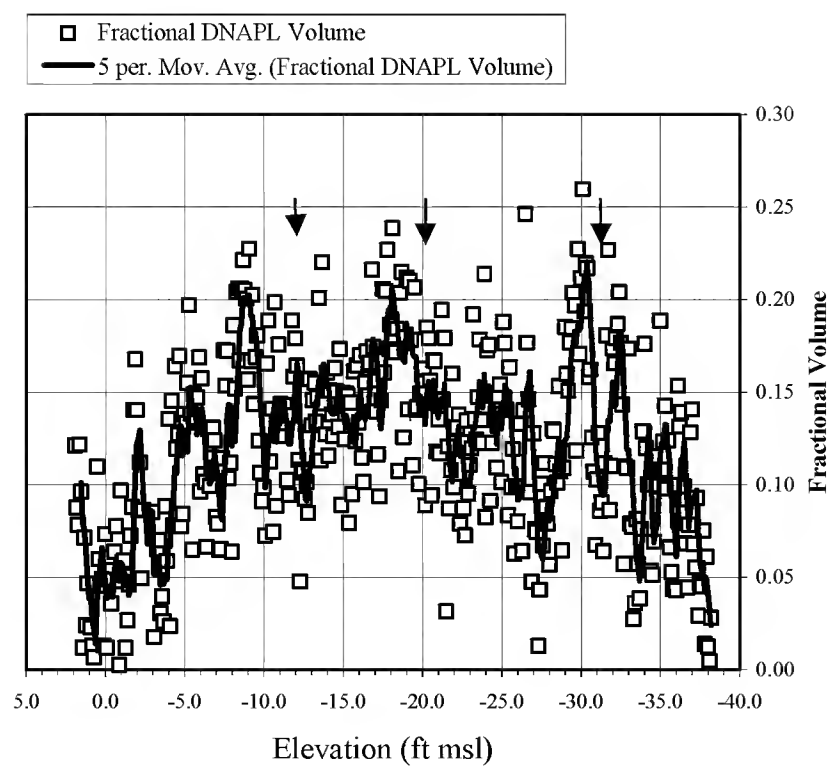


Fig. 17

Figure 10. DNAPL saturation versus elevation.

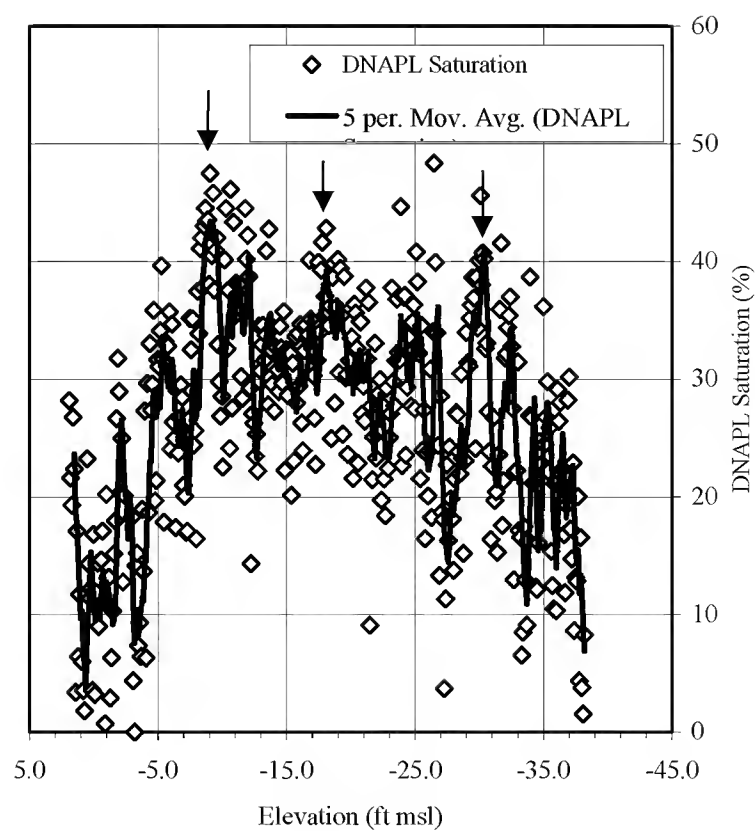


Fig. 18

